WATER SUPPLY OUTLOOK
and
FEDERAL - STATE - PRIVATE COOPERATIVE SNOW SURVEYS
for
WESTERN UNITED STATES
Including Columbia River Drainage in Canada

UNITED STATES DEPARTMENT of AGRICULTURE···SOIL CONSERVATION SERVICE
Collaborating with
CALIFORNIA DEPARTMENT of WATER RESOURCES
and
BRITISH COLUMBIA DEPARTMENT of
LANDS, FORESTS and WATER RESOURCES

AS OF
MAR. 1, 1963

UNITED STATES DEPARTMENT OF AGRICULTURE - SOIL CONSERVATION SERVICE

To Recipients of Water Supply Outlook Reports:

The climate of the cultivated and populated areas of the West is characterized by relatively dry summer months. Such precipitation as occurs falls mostly in the winter and early spring months when it is of little immediate benefit to growing crops. Most of this precipitation falls as mountain snow which stays on the ground for months, melting later to sustain streamflow during the period of greatest demand during late spring and summer. Thus, nature provides in mountain snow an imposing water storage facility.

The amount of water stored in mountain snow varies from place to place as well as from year to year and accordingly, so does the runoff of the streams. The best seasonal management of variable western water supplies results from advance estimates of the streamflow.

A snow survey consists of a series of about ten samples taken with specially designed snow sampling equipment along a permanently marked line, up to 1000 feet in length, called a snow course. The use of snow sampling equipment provides snow depth and water equivalent values for each sampling point. The average of these values is reported as the snow survey measurement for a snow course.

Snow surveys are made monthly or semi-monthly beginning in January or February and continue through the snow season until April, May or June. Currently more than 1400 western snow courses are measured each year. These measurements furnish the key data for water supply forecasts.

Streamflow forecasts are obtained by a comparison of total or maximum snow accumulation, as measured by snow water equivalent, to the subsequent spring and summer or snowmelt season runoff over a period of years. The snow water equivalent measured in selected snow courses provides most of the index to the streamflow forecast for the following season. More accurate forecasts are usually obtained when other factors such as soil moisture, base flow and spring precipitation are considered and included in the forecast procedure. Early season forecasts assume average climatic conditions through the snowmelt season.

Listed below are the Federal-State-Private Cooperative Snow Survey and Water Supply Forecast reports available for the West which contain detailed information on snow survey measurements, streamflow forecasts, reservoir storage, soil moisture and other guide data to water management and conservation decisions. Soil Conservation Service Reports may be secured from Water Supply Forecasting Unit, Soil Conservation Service, P.O. Box 4170, Portland 8, Oregon.

PUBLISHED BY SOIL CONSERVATION SERVICE

REPORTS	ISSUED	LOCATION	COOPERATING WITH
RIVER BASINS			
WESTERN UNITED STATES	MONTHLY (FEB.-MAY)	PORTLAND, OREGON	ALL COOPERATORS
STATES			
ALASKA	MONTHLY (MAR.-MAY)	PALMER, ALASKA	ALASKA S.C.D.
ARIZONA	SEMI-MONTHLY (JAN.15 - APR.1)	PHOENIX, ARIZONA	SALT R. VALLEY WATER USERS ASSOC. ARIZ. AGR. EXP. STATION
COLORADO AND NEW MEXICO	MONTHLY (FEB.-MAY)	FORT COLLINS, COLORADO	COLO. STATE UNIVERSITY COLO. STATE ENGINEER N. MEX. STATE ENGINEER
IDAHO	MONTHLY (JAN.-JUNE)	BOISE, IDAHO	IDAHO STATE RECLAMATION ENGINEER
MONTANA	MONTHLY (JAN.-JUNE)	BOZEMAN, MONTANA	MONT. AGR. EXP. STATION
NEVADA	MONTHLY (JAN.-MAY)	RENO, NEVADA	NEVADA DEPT. OF CONSERVATION AND NATURAL RESOURCES - DIVISION OF WATER RESOURCES
OREGON	MONTHLY (JAN.-JUNE)	PORTLAND, OREGON	OREG. STATE UNIVERSITY OREGON STATE ENGINEER
UTAH	MONTHLY (JAN.-JUNE)	SALT LAKE CITY, UTAH	UTAH STATE ENGINEER
WASHINGTON	MONTHLY (FEB.-JUNE)	SPOKANE, WASHINGTON	WN. STATE DEPT. OF CONSERVATION
WYOMING	MONTHLY (FEB.-JUNE)	CASPER, WYOMING	WYOMING STATE ENGINEER

PUBLISHED BY OTHER AGENCIES

REPORTS	ISSUED	AGENCY
BRITISH COLUMBIA	MONTHLY (FEB.-JUNE)	WATER RIGHTS BR., DEPT. OF LANDS, FORESTS AND NATURAL RESOURCES, PARLIAMENT BLDG., VICTORIA, B.C., CANADA
CALIFORNIA	MONTHLY (FEB.-MAY)	CALIF. DEPT. OF WATER RESOURCES, P.O. BOX 388, SACRAMENTO, CALIF.

USDA-SCS PORTLAND OREG 1962

WATER SUPPLY OUTLOOK
and
FEDERAL - STATE - PRIVATE COOPERATIVE SNOW SURVEYS
for
WESTERN UNITED STATES
Including Columbia River Drainage in Canada

ISSUED

MARCH 8, 1963

The Soil Conservation Service coordinates Snow Surveys conducted by its staff and many cooperators, including the Bureau of Reclamation, Corps of Engineers, Forest Service, National Park Service, Geological Surveys, and other Federal Agencies, Departments of State Government, Irrigation Districts, Power Companies, and others.

The Department of Water Resources coordinates snow surveys in California.

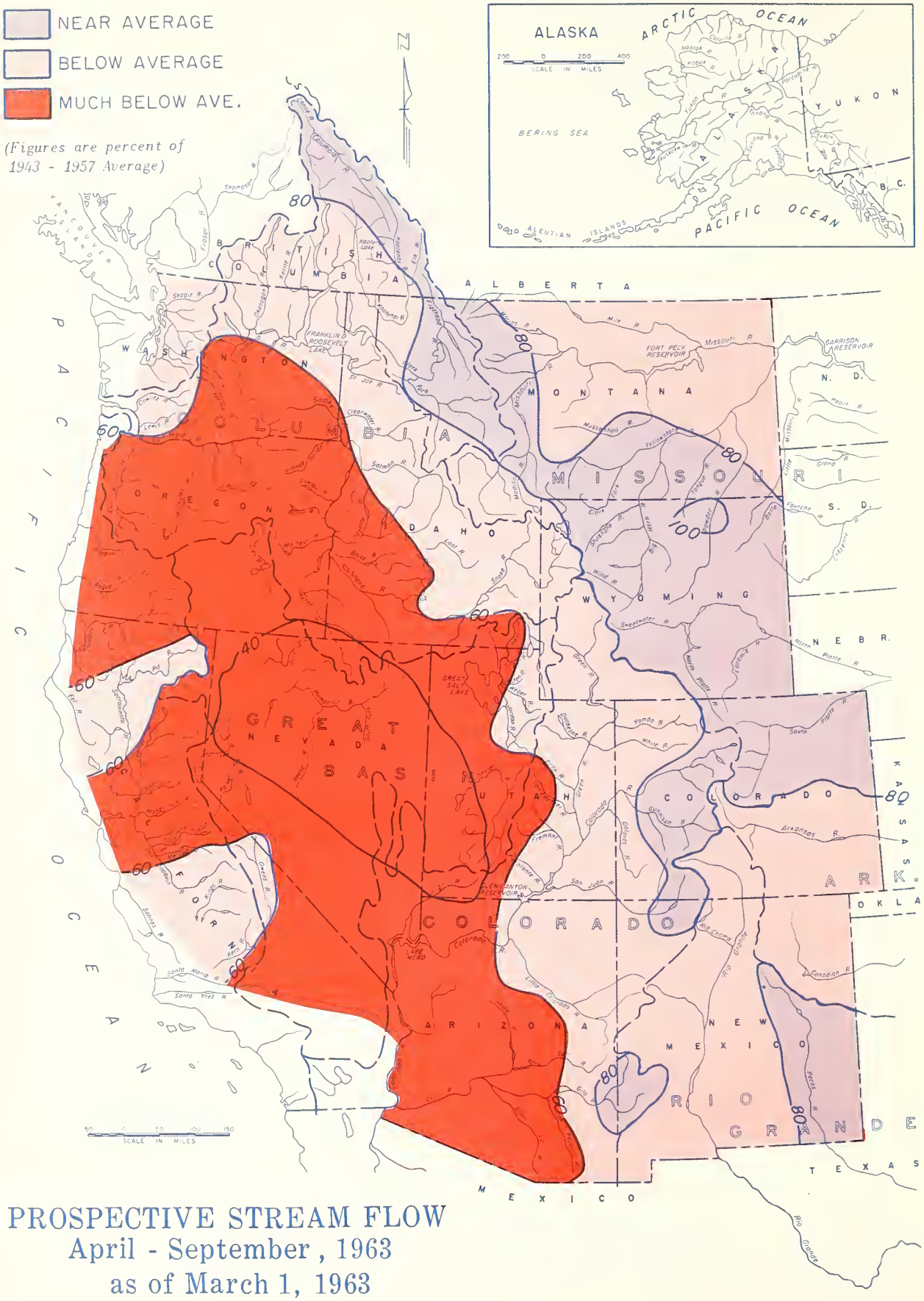
The Water Resources Service, Department of Lands, Forests, and Water Resources directs snow surveys in British Columbia.

This report is prepared under the direction of R. A. Work, Head, Water Supply Forecasting Unit, Soil Conservation Service, Portland, Oregon, from data and reports supplied by Snow Survey Supervisors of the Soil Conservation Service: Arizona, Richard W. Enz; Colorado and New Mexico, Jack N. Washichek; Idaho, M. W. Nelson; Montana, Phil E. Farnes; Nevada, Manes Barton; Oregon, W. T. Frost; Utah, Gregory L. Pearson; Washington, Robert T. Davis; Wyoming, George W. Peak.

California....Dept. of Water Resources, Robert W. Miller, Chief, Water Supply Forecast and Snow Surveys Unit.

British Columbia.....Dept. of Lands, Forests, and Water Resources, Harry I. Hunter, Meteorologist, Water Rights Branch.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
D. A. Williams, Administrator



PROSPECTIVE STREAM FLOW
April - September , 1963
as of March 1, 1963

WATER SUPPLY OUTLOOK

As of March 1, 1963

SNOWMELT SEASON STREAMFLOW IS EXPECTED TO BE LESS THAN AVERAGE IN WESTERN UNITED STATES FOR 1963. TOTAL SURFACE SUPPLIES FOR IRRIGATION WILL BE MUCH LESS THAN FOR 1962 BUT GENERALLY IN EXCESS OF 1961. WEST OF THE CONTINENTAL DIVIDE SEVERE SHORTAGES ARE IN PROSPECT FOR MOST OF UTAH, NEVADA, EASTERN OREGON, AND ON TRIBUTARIES TO THE SNAKE RIVER OF IDAHO WHERE STORAGE IS NOT ADEQUATE.

For many irrigated areas of the western states, and particularly those west of the Continental Divide, the adequacy of water supplies for 1963 will be at least as dependent on water now in storage as on streamflow during the summer months. Carryover water from the plentiful streamflow year of 1962 and the winter of 1963 is the principal factor that differentiates a fair water supply outlook for this year from a universal shortage.

Mountain snowpack along and near the Continental Divide maintained an average rate of accumulation during February and improved slightly in relation to average over the Platte and Upper Missouri headwaters. With snowfall on the first two days of March, these watersheds have a seasonal snowpack 70 to 90 percent of average for this date.

For the west coast states, from the Cascades of Washington and Oregon to the southern Sierras of California, mountain snowpack remains far below average and near or below the record for recent years. Total precipitation has been closer to average than the snowpack would indicate. In a few areas precipitation has been greater than average. An unusual sequence of storms and temperatures, most notable in the northwest, has prevented the build-up of a mountain snowpack except at the highest elevations. Seasonal snowpacks of less than 25 percent of average for this date are commonplace.

Winter streamflow has been above average in the far west. General storms in early February caused flood runoff in a few local areas. This trend of high winter runoff persisted through the month of February, not only in the west coast states, but in the interior states of Arizona, Utah, and Idaho. These winter flows improved reservoir storage where facilities were available.

With mountain snowpack remaining extremely short in west coast states to March 1, the opportunity for summer streamflow approaching normal is practically nil. Most probable streamflow forecasts range from 40 to 60 percent of average for the high irrigation demand areas. An increasing dependence for irrigation water will have to be in stored supplies for Nevada, the large Central Valley of California, eastern Oregon, and the Yakima Valley of Washington.

Irrigated areas along the Snake River and its main tributaries in Idaho will be adequate for irrigated areas with full storage rights. Water users along small streams and in fringe areas of the larger projects may expect some shortages. The already poor water supply outlook for the Great Basin, including most of Utah and Nevada, declined during February to where critical shortages are in prospect even with average or better storage. The outlook for the Salt and Gila rivers remains good. Much of the streamflow from midwinter snowpack has already occurred, increasing storage in reservoirs to much above average.

East of the Continental Divide streamflow forecasts range near 80 percent of average except for the Rio Grande. Combining storage and prospective streamflow, no material water shortages are expected for the Missouri River and its tributaries. A limited shortage of both storage and streamflow will place restrictions on water use along both the Arkansas and the Rio Grande.

With the present outlook, conservation of water supplies is imperative for 1963. If the snowfall next winter is again less than average, there will not be a cushion of stored water to alleviate shortages during the ensuing year.

MISSOURI BASIN

Mountain snowpack on the headwaters of the Missouri and most of its tributaries is below average. Near average snow cover has accumulated on the headwaters of the Gallatin and on the Bridger Mountains in Montana and on the Bighorn Mountains of north central Wyoming. Some improvement has occurred along the Continental Divide west of the Bighorn River and on the Platte River drainages of Colorado and Wyoming. Only local irrigation shortages can

be expected in the basin if average snowfall occurs during the early spring months. Reservoir storage is generally available to supplement the expected less-than-average streamflow during the snowmelt season.

MONTANA

Streamflows are forecast at slightly less than average for the 1963 season. Irrigation water supplies are reasonably assured for the areas along the larger streams, the Yellowstone and the Missouri and its tributaries above Three Forks. Snow cover has been light on the headwaters of the Beaverhead tributary to the Jefferson where late season shortages are a definite prospect. Lack of seasonal snowfall and carryover storage will limit water supplies along the Marias and Milk rivers in north central Montana and on Red Rock Creek, tributary to the Yellowstone. Soil moisture is near or above average except on the northern tributaries to the Missouri.

WYOMING

Water supply outlook improved on the headwaters of the Wind and Shoshone rivers during February. The outlook for below average streamflow for the snowmelt season remains. There is still some possibility of shortages in late season water supply for some smaller tributaries from the Continental Divide range west of the Powell Basin. The flow of the Wind River and the Shoshone combined with storage should provide an adequate water supply along these streams. The flow of smaller streams originating in the Bighorn Mountains is expected to be near average. Storage is limited in this area, and shortages may occur in late season if drouth conditions prevail during the summer months.

With carryover storage at near average levels on the North Platte and Laramie rivers the outlook is good for irrigation water supplies along these streams. The snowpack on the headwaters improved during March to near 80 percent of average on the North Platte and Laramie. With average snowfall for the spring months, no shortages are in prospect for this watershed.

COLORADO

The outlook for streamflow on the South Platte and tributaries improved substantially during March with streamflow forecasts now slightly below average. Storage in smaller irrigation reservoirs in the upper irrigated areas is above average. Storage along the lower South Platte is well in excess of average and near capacity. The resources of the Colorado-Big Thompson project will be fully available to supplement streamflow. With near average flow in prospect added to substantial reservoir storage, the water supply outlook is good. Municipal reservoir storage is above average.

ARKANSAS BASIN

The outlook for irrigation water supplies along the Arkansas and its tributaries in Colorado and western Kansas, while improving somewhat during February, remains unfavorable. Streamflow forecasts range from 60 to 80 percent of average. Storage in John Martin and smaller irrigation reservoirs is very short. Should the snowfall in the mountains for the remainder of the season be only average, the total water supply from surface sources will limit crop acreage to those lands with earlier rights.

Although the flow of the Canadian River in New Mexico will probably be less than average, storage in Conchas Reservoir is above average and comparable to a year ago.

RIO GRANDE BASIN

A limited surface water supply for 1963 remains in prospect for the San Luis Valley of Colorado. Snow cover on the Continental Divide Range increased during February to about 80 percent of average for March 1. Extensive use of groundwater will again be prevalent.

Seasonal snowfall has been somewhat greater in northern New Mexico than in southern Colorado. Some snow courses at the southern limits of the Sangre de Cristo Range have above average water contents. The flow of the Rio Grande at Otowi Bridge for the middle Rio Grande district is expected to be slightly less than for the 1943-57 average and similar to the past two or three years. In the lower Rio Grande, inflow to Elephant Butte will be less than average and also typical of recent years. Storage in Elephant Butte is below average and slightly greater than for a year ago. Total surface water supplies will continue to be substantially less than demands.

The outlook for irrigated areas along the Pecos is good. Storage in Alamogordo and other reservoirs is relatively high, but not at capacity as it was a year ago.

COLORADO BASIN

The unimpaired flow of the Colorado River into Lake Mead is forecast at 6,000,000 acre-feet for the April-September 1963 period or 66 percent of average, and one-half of the flow for 1962. Actual inflow will be much less, depending on operations at Powell, Navajo, and Flaming Gorge reservoirs upstream.

Upper Basin

The seasonal snowpack to date is less than average over the entire basin. There was some improvement in the snow water contents during February with 70 to 90 percent

SUMMARY OF SNOW WATER EQUIVALENT MEASUREMENTS

MARCH 1, 1963

MAJOR BASIN AND SUB—WATERSHED	WATER EQUIVALENT IN PERCENT OF: LAST YEAR	AVERAGE
MISSOURI BASIN		
Jefferson	66	68
Madison	47	56
Gallatin	72	88
Missouri Main Stem	72	65
Yellowstone	62	71
Shoshone	86	69
Wind	65	76
North Platte	65	80
South Platte	60	85
ARKANSAS BASIN		
Arkansas	51	75
Canadian	71	89
RIO GRANDE BASIN		
Rio Grande (Colo.)	64	82
Rio Grande above Otowi Bridge	71	90
Pecos	101	156
COLORADO BASIN		
Green (Wyo.)	62	78
Yampa - White	53	77
Duchesne	29	36
Price	42	60
Upper Colorado	50	71
Gunnison	64	87
San Juan	61	76
Dolores	67	91
Virgin	5	6
Gila	26	53
Salt	19	33
GREAT BASIN		
Bear	62	69
Logan	57	59
Ogden	40	47
Weber	57	58
Provo - Utah Lake	46	51
Jordan	49	51
Sevier	34	45
Walker - Carson	51	63
Tahoe - Truckee	22	23
Humboldt	6	6
Lake Co. (Oregon)	12	14
Harney Basin (Oregon)	8	7
UPPER COLUMBIA BASIN		
Columbia (Canada)	84	90
Kootenai	74	66
Clark Fork	79	79
Bitterroot	60	61
Flathead	74	75
Spokane	51	49
Okanogan	49	45
Methow	94	59
Chelan	79	52
Wenatchee	32	26

MAJOR BASIN AND SUB—WATERSHED	WATER EQUIVALENT IN PERCENT OF: LAST YEAR	AVERAGE
SNAKE BASIN		
Snake above Jackson, Wyo.	57	63
Snake above Hiese, Idaho	64	71
Snake above American Falls Res	59	66
Henry's Fork	45	52
Southern Idaho Tributaries	44	47
Big and Little Wood	60	58
Boise	61	56
Owyhee	13	14
Payette	52	54
Malheur	32	27
Weiser	43	43
Burnt	16	16
Powder	43	40
Salmon	73	68
Grande Ronde	38	35
Clearwater	54	53
LOWER COLUMBIA BASIN		
Yakima	51	33
Umatilla	32	24
John Day	48	42
Deschutes - Crooked	30	28
Hood	22	14
Willamette	22	18
Lewis	32	25
Cowlitz	44	31
PACIFIC COASTAL BASIN		
Puget Sound	49	32
Olympic Peninsula	31	20
Umpqua - Rogue	25	20
Klamath	23	22
Trinity	1	1
CALIFORNIA CENTRAL VALLEY		
Upper Sacramento	22	25
Feather	1	1
Yuba	0	0
American	12	13
Mokelumne	11	12
Stanislaus	16	19
Tuolumne	34	42
Merced	32	41
San Joaquin	48	62
Kings	35	45
Kaweah	18	22
Tule	18	22
Kern	45	65

Data for California Watersheds supplied by Dept. of Water Resources, and for British Columbia Watersheds by Dept. of Lands, Forests and Water Resources.

Average is for 1943-57 period.

Based on Selected Snow Courses determined by Distribution within the Basin, Length of Record and Repetitive Monthly Measurement Schedules.

SELECTED STREAMFLOW FORECASTS APRIL - SEPTEMBER AS OF MARCH 1, 1963

STREAM AND STATION	1000 ACRE-FEET		PERCENT OF AVERAGE
	FLOW 1962	FORECAST 1963	
UPPER MISSOURI			
Clark Fork at Chance, Montana	662	506	82
Gallatin near Gateway, Montana		430	94
Jefferson at Sappington, Montana		817	76
Madison near Grayling, Montana 1/		346	77
Missouri near Zortman, Montana 2/		3357	70
Missouri near Williston, N. Dakota 3/	13381	9623	77
Yellowstone at Corwin Springs, Montana	2266	1699	86
Yellowstone at Miles City, Montana	7114	5673	84
Shoshone below Buffalo Bill Res., Wyoming 4/		740	87
Wind at Dubois, Wyoming		89	89
PLATTE			
Clear at Golden, Colorado 5/		124	91
North Platte at Saratoga, Wyoming	983	538	81
Cache LaPoudre near Ft. Collins, Colorado 6/		150	79
ARKANSAS			
Arkansas at Salida, Colorado 7/		265	78
RIO GRANDE			
Rio Grande near Del Norte, Colorado 8/		330	67
Rio Grande at Otowi Bridge, New Mexico 9/	771	440	70
Pecos at Pecos, New Mexico *		48	100
UPPER COLORADO			
Animas at Durango, Colorado	491	375	79
Colorado at Glenwood Springs, Colorado 10/		1300	84
Colorado near Cisco, Utah	5191	3400	84
Colorado near Grand Canyon, Arizona 11/	11582	6000	66
Duchesne near Tabiona, Utah 12/		78	63
Green near Greendale, Utah 13/		895	61
Green near Green River, Utah 13/		1857	52
Gunnison near Grand Junction, Colorado		1200	82
Price near Scofield, Utah 14/		20	50
San Juan near Bluff, Utah 15/		900	73
White at Meeker, Colorado		225	67
Yampa at Steamboat Springs, Colorado	389	200	71
LOWER COLORADO			
Gila at Virden, Arizona (Mar.-May)	63	29	103
Salt at Intake, Arizona (Mar.-May)	418	120	60
Verde above Horseshoe Dam, Arizona (Mar.-May)	135	54	48
GREAT BASIN			
Bear at Harer, Idaho 16/		125	42
Logan near Logan, Utah 17/	140	80	56
Ogden, Inflow to Pine View Res., Utah 18/ (Mar.-July)	142	62	44
Provo at Vivian Park, Utah 19/		100	63
Sevier at Hatch, Utah 20/		18	38
Sevier near Kingston, Utah		4	13
Humboldt at Palisades, Nevada **	267	35	16
Truckee at Farad, California ** 21/	261	70	27
West Walker near Coleville, California **	155	80	54

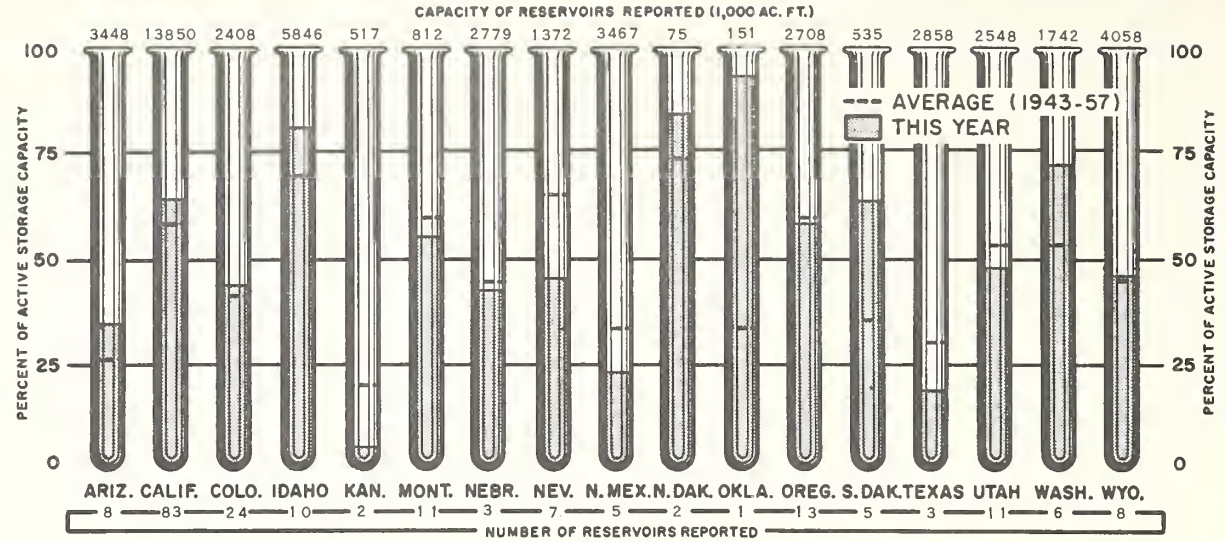
Forecasts in California provided by Department of Water Resources.
Average is for 1943-57 period except California. California is computed for 1908-57 period.
Forecasts assume average Effective Climatic Conditions from Date Through Snow Melt Season.

SELECTED STREAMFLOW FORECASTS APRIL - SEPTEMBER AS OF MARCH 1, 1963

STREAM AND STATION	1000 ACRE-FEET		PERCENT OF AVERAGE
	FLOW 1962	FORECAST 1963	
UPPER COLUMBIA			
Bitterroot near Darby, Montana	548	430	73
Chelan at Chelan, Washington 22/		975	76
Clark Fork above Missoula, Montana	1859	1585	87
Clark Fork at Whitehorse Rapids, Montana 23/	13324	10792	77
Columbia at Revelstoke, British Columbia		19000	98
Columbia at Birchbank, British Columbia 24/	37800	36020	84
Columbia at Grand Coulee, Washington 24/	62300	54800	81
Columbia at The Dalles, Oregon 24/	92700	78700	74
Flathead near Polson, Montana 23/	7073	5987	80
Kootenai at Wardner, British Columbia	4150	4150	85
Kootenai at Leonia, Idaho	7605	6633	74
Okanogan near Tonasket, Washington		1300	68
Spokane at Post Falls, Idaho 25/	3050	2100	65
SNAKE			
Big Lost, Inflow to Mackay Res., Idaho 26/		114	66
Big Wood, Inflow to Magic Res., Idaho 27/		160	52
Boise above Diversion Dam, Idaho 28/		1000	59
Clearwater at Spalding, Idaho	8370	5910	65
Malheur near Drewsey, Oregon	62	24	30
Owyhee Res. Net Inflow, Oregon 18/	340	70	13
Payette near Horseshoe Bend, Idaho 29/		1200	60
Salmon at Whitebird, Idaho	6180	5000	70
Snake near Heise, Idaho 30/	4260	2900	70
Snake at Weiser, Idaho	5190	5600	72
LOWER COLUMBIA			
Cowlitz at Castle Rock, Washington		2150	75
Deschutes at Benham Falls, Oregon 31/		360	60
Grande Ronde near LaGrande, Oregon	148	95	47
Hood near Hood River, Oregon 32/	357	230	63
Willamette at Salem, Oregon 33/	5984	3272	60
Yakima near Parker, Washington 34/		740	38
NORTH PACIFIC COASTAL			
Dungeness near Sequin, Washington		135	80
Rogue at Raygold near Central Point, Oregon	792	575	57
Klamath Lake, Net Inflow, Oregon 35/	447	323	51
CALIFORNIA CENTRAL VALLEY 36/**			
American, Inflow to Folsom Res., Calif.		520	37
Feather near Oroville, Calif.		800	40
Kaweah near Three Rivers, Calif. 37/		125	47
Kern near Bakersfield, Calif.		280	63
Kings, Inflow to Pine Flat Res., Calif.		770	65
Merced, Inflow to Exchequer Res., Calif.		350	56
Mokelumne, Inflow to Pardee Res., Calif.		145	30
Sacramento, Inflow to Shasta Res., Calif.		1280	71
San Joaquin, Inflow to Friant Res., Calif.		820	67
Stanislaus, Inflow to Melones Res., Calif.		330	45
Tule, Inflow to Success Res., Calif.		15	26
Tuolumne, Inflow to Don Pedro Res., Calif.		640	53
Yuba at Smartville, Calif.		280	25

Explanatory Notes on Forecasts Listed on Inside Back Cover.
** April - June Period ** April - July Period*

RESERVOIR STORAGE as of March 1, 1963



of average for March 1 in the principal water contributing snow areas in Wyoming, Colorado and northwestern New Mexico. Water supplies will be adequate throughout the season for the Yampa, White, Upper Colorado, Gunnison, San Juan, and Animas rivers and their tributaries. Some smaller tributaries such as the North Fork of the Gunnison, Florida, and La Plata may have late season shortages. Inflow to the new Flaming Gorge Reservoir is expected to be about 60 percent of average.

After a temporary improvement in water supply outlook for the Colorado River tributaries in Utah in early February, the outlook is again extremely poor as of March 1. Summer flows of streams in the Uintah Basin are expected to be less than one-half of average and comparable to or less than the flows experienced in 1960 and 1961. Only about one-half average flows are in prospect for the Price River and other Green and Colorado tributaries to the southwest.

The water supply for lands along the Virgin River is forecast at less than that available in 1961. Reservoir storage on the tributaries is substantially below average. The opportunity to recover reservoir storage in 1962 was limited and winter streamflow has not been of great importance. Snowfall for March and April will have to be far in excess of average to effect any material improvement in this area.

ARIZONA

The 1963 water supply outlook for Arizona is near average for the major irrigation projects. Snow cover on March 1 is very low on the mountain watersheds, ranging from less than 10 percent of average on the Verde to about 50 percent of average on the Salt and Gila.

Storage in San Carlos and Salt River Project reservoirs showed a substantial improvement in recent weeks, adding to an already favorable storage situation. Recent streamflow has been far in excess of average. Streamflow during the spring months will range near 50 percent of average for all streams except the Upper Gila where near average flows are in prospect. Should there be substantial snowfall in March, the outlook could improve materially. Soils in the high elevation snow areas are in saturated condition.

The water supply outlook along the Little Colorado and Verde rivers is relatively poor.

GREAT BASIN

UTAH

The water supply outlook for all streams in the Great Basin area of Utah is poor to extremely poor. Most forecasts range between 20 percent and 55 percent of average for these rivers. The best prospects are for the Provo and Logan rivers which are forecast to flow 63 and 56 percent of average, respectively. The Sevier at Kingston is forecast at only 13 percent of normal. Low reservoir storage complicates the problem for water users on the Sevier and Beaver rivers in southern Utah, and those served by Utah Lake and Strawberry reservoirs. The general outlook is comparable to 1961. Some reservoirs in northern Utah have near or above average storage which will help those with rights to stored water.

Warm temperatures and light precipitation during the last month have resulted in the mountain snowpack being reduced from a fair condition on February 1 to very poor on March

STORAGE IN LARGE RESERVOIRS

MARCH 1, 1963

BASIN AND NAME OF RESERVOIR	CAPACITY (1000A.F.)	STORAGE (1000A.F.)
UPPER MISSOURI		
Boysen	560	340
Buffalo Bill	380	168
Canyon Ferry	2043	1973
Hebgen	385	249
Tiber	1316	650
Belle Fourche	185	160
Keyhole	190	67
Fort Peck	19410	10022
Fort Randall	6100	3546
Garrison	24500	12561
Oahe	23600	9993
PLATTE		
Glendo	786	360
Pathfinder	1011	529
Seminoe	982	308
Colo-Big Thompson (4)	865	487
City of Denver (4)	218	169
ARKANSAS		
Conchas	600	200
John Martin	367	18
RIO GRANDE		
Elephant Butte	2207	423
El Vado	194	2
UPPER COLORADO		
Flaming Gorge	3789	68
Navajo	1709	102
Powell	28000	135
LOWER COLORADO		
Havusu	619	516
Mead	27207	22496
Mohave	1810	1701
San Carlos	1206	132
Salt River Res. (4)	1755	1060
Verde River Res. (2)	322	22
GREAT BASIN		
Bear	1421	761
Lahontan	286	238
Rye Patch	179	80
Sevier Bridge	236	58
Strawberry	270	53
Tahoe	732	235
Utah	1149	278

BASIN AND NAME OF RESERVOIR	CAPACITY (1000A.F.)	STORAGE (1000A.F.)
UPPER COLUMBIA		
Chelan	676	379
Coeur d'Alene	238	172
Flathead	1791	1126
Hungry Horse	3428	2772
Kootenay	817	464
Pend Oreille	1561	1070
Roosevelt	5232	2936
LOWER COLUMBIA		
Detroit	300	164
Hills Creek	356	105
Lookout Point	337	172
Yakima Res. (5)	1065	880
SNAKE		
American Falls	1700	1482
Arrowrock	287	274
Anderson Ranch	423	304
Brownlee	1427	1215
Cascade	653	579
Jackson	847	582
Lucky Peak	278	144
Palisades	1202	1003
Owyhee	715	344
PACIFIC COASTAL		
Clear Lake (Ore.)	440	132
Upper Klamath	584	499
Ross	1203	1221
Trinity	2500	2392
CALIFORNIA CENTRAL VALLEY		
Almanor	650	422
Berryessa	1600	1442
Cachuma	206	185
Casitas	248	51
Cherry Valley	268	152
Don Pedro	260	189
Folsom	1010	626
Hetch-Hetchy	360	157
Isabella	552	174
McClure	281	190
Millerton	503	422
Nacimiento	350	220
Pardee	210	179
Pine Flat	1001	513
Shasta	4500	3438
Twitchell	250	3

Reservoir Storage Data Provided by Bureau of Reclamation, Corps of Engineers, Geological Survey, and water using organizations. Data from California and British Columbia provided by Department of Water Resources and Department of Lands, Forests and Water Resources, respectively.

1. Snow cover is extremely light over most of the state. Several of the important snow courses in southern Utah register the lowest on record. There is no reasonable probability that sufficient snowfall will occur later in the season to materially improve the present outlook.

NEVADA

April-July streamflow forecasts indicate that runoff will be much below average, all less than one-half of average. In aggregate, storage in all principal reservoirs in Nevada except Lake Tahoe is well above average for March 1. Water users served from these reservoirs should have a moderately adequate irrigation season water supply. Nevada water users without reservoir facilities will have an extremely poor water supply this coming spring and summer.

With but few exceptions the March 1, 1963 mountain snowpack is the poorest of record. The snowline is 1500 to 2000 feet higher than normal for this time of year.

Mountain soil moisture conditions are variable throughout the state. In northwestern Nevada the soils are wet, elsewhere they range from moist to dry.

OREGON

Snowpack in the south central portion of Oregon is extremely light with many courses reporting the lowest on record. Harney Basin and Lake County have only 14 and 7 percent respectively of average snow cover at this time. Reservoir storage is limited in this area. The water supply outlook is poor and severe shortages are indicated for this section of the state.

COLUMBIA BASIN

Snow cover continues to be much below normal over the entire Columbia Basin except in the Big Bend area of British Columbia where a 90 percent of average snowpack is reported. The watersheds in Washington and Oregon are extremely deficient in snowpack, with many snow course readings the lowest on record. The flow of the Columbia at The Dalles for the April-September 1963 period is now forecast at 78,700,000 acre-feet, or only 74 percent of average.

BRITISH COLUMBIA

The Water Resources Service of British Columbia reports that a very light snowpack exists at lower elevations of mountain watersheds. Record low, or near record low snow water equivalents have been reported from most of the snow courses at these levels. At the higher elevations snowpack improves considerably with an average snow cover reported in the Big Bend area.

Irrigated areas along the Okanogan and Similkameen rivers can expect some water shortages if the present weather pattern continues. The main stem of the Columbia River in Canada is forecast to flow near average at Revelstoke and 84 percent of average at Birchbank.

MONTANA

Snow cover in the Flathead and Clark Fork drainage areas of Montana is relatively good with 75 percent and 79 percent of average snow water equivalent for March 1. The Kootenai and Bitterroot watersheds have about 65 percent of normal snowpack and are forecast to flow at 74 percent of average for the April-September period. Storage in the power reservoirs in western Montana is near average for March 1. Irrigation water supplies in this portion of Montana will be considerably less than average but are expected to be adequate, except for the Bitterroot.

IDAHO

Warm temperatures which resulted in early snowmelt and near record runoff during the month of February greatly improved the reservoir storage along the Snake and Boise rivers. Water supplies in storage on these rivers are now considerably above average. Snow cover is extremely low on watersheds of the southern tributary streams of the Snake River. It is expected that shortages will be experienced in those irrigated areas without adequate reservoir storage. The Snake River at Heise is forecast to flow 70 percent of normal which may result in some shortages in a few irrigated areas with limited storage rights.

Snow cover for the Salmon, Clearwater, Spokane, and other northern Idaho streams is also deficient, and these rivers are forecast to flow at 65 to 70 percent of average.

WASHINGTON

Forecasts of streamflow in Washington are much below average for 1963 including that of the Columbia River through the state. Snow surveys on March 1 indicated a snow water content ranging from only 19 percent of average in the Cascades up to about half of average in a few other areas. Many snow water contents were measured as the lowest of record for March 1.

For the large irrigated area served by the Yakima River, the outlook is fair. Snowmelt season streamflow is expected to be only one-third of average, but storage in reservoirs should make up most of the deficiency unless summer demands are excessive. The flow of the Okanogan River and its tributaries will be extremely low, and water shortages for irrigation appear certain in these areas. Conconully and Salmon reservoirs have a record low storage for this date.

Winter precipitation has been generally less than average. Such as has occurred has been in the form of rain rather than snow which, in common with other west coast states, has provided high winter streamflow.

OREGON

The 1963 irrigation water outlook for Oregon is extremely poor except for those areas which have adequate stored water supplies. Snowpack in mountain areas, except for the northeast section of the state, is the lowest of record for March 1. Water content of snow on a state-wide basis is only 20 percent of average. While winter streamflow has been high, summer flows from snowmelt will be near a minimum of record.

The most favorable part of the water outlook is the relative adequacy of storage. In 23 major reservoirs, storage is 105 percent of average for March 1. Not all irrigated areas have adequate storage to eliminate the probability of late season shortages. Among these areas are lands served by Agency Valley and Warm Springs reservoirs in Malheur County and McKay Reservoir in Umatilla County. Lands under Fish Lake and Four Mile reservoirs in Jackson County are also short of stored water but may expect a supplemental supply from the Talent Irrigation District.

CALIFORNIA

The California Department of Water Resources, coordinating agency for snow surveys and water supply forecasting program in California, reports that, as of March 1, water supply conditions during the spring and summer season this year will be seriously short in many areas of California. The situation has worsened considerably from that which was reported one month ago, primarily because normal or (hopefully) above normal snowpack accumulation was generally not received during February, and therefore the snowpack is falling further behind with respect to average as the season progresses. Normally by March 1, 85 to 90 percent of seasonal snowpack has accumulated; however, in the vital Central Valley area this year, snowpack accumulation ranges from near zero on the Feather and Yuba river basins in the Sacramento Valley area to a high of only 65 percent of normal on the Kern River basin in the San Joaquin Valley. The Owens River watershed on the east side of the Sierras in the Lahontan area was the only major basin in the state with normal snowpack on March 1.

Heavy storm runoff, resulting from the warm rains of early and mid-February, was augmented by considerable snowmelt runoff in most Central Valley watersheds. This produced February flows in many of the major water producing streams that approach near record value and resulted in an aggregate monthly runoff in the Central Valley area which exceeded 200 percent of normal. The Truckee, Carson, and Walker river basin in the Lahontan area also experienced unusually high flows in the order of 500 percent of February average. Streamflow for the season to date was approximately 150 percent of normal for the entire state, as well as for the Central Valley area.

The South Coastal and Colorado desert areas are the only major hydrologic areas in which below normal runoff conditions exist; runoff in both of these areas was considerably below normal for both February and the season to date.

The excessive February runoff resulted in a gain in reservoir storage throughout California. Total water in storage at month's end amounted to 111 percent of the average. The most significant increases occurred in reservoirs which serve the Central Valley. Storage in Sacramento Valley reservoirs was 106 percent, and in the San Joaquin Valley it reached 139 percent of the March 1 average. With Lake Mead 83 percent of capacity, the major agricultural areas of California that have access to these supplies should experience no problem during the coming season. However, since the recent reservoir inflow is substantially composed of water which would ordinarily be stored in the snow, the need for rigorous control of water presently held in storage should be emphasized. Although above average reservoir storage exists in most areas, the prospect of subnormal inflow of only 25 to 70 percent of average during the coming months will tend to nullify the present conditions of apparent abundance in reservoirs which depend so heavily on the spring snowmelt runoff.

EXPLANATION of STREAMFLOW FORECASTS

1/ Observed flow adjusted for change in storage in Hebgen Lake. 2/ Observed flow adjusted for change in storage in Canyon Ferry and Tiber reservoirs. 3/ Observed flow adjusted for change in storage in Canyon Ferry, Tiber, Fort Peck, Buffalo Bill, and Boysen reservoirs. 4/ Observed flow adjusted for change in storage in Buffalo Bill Reservoir plus Heart Mt. Diversion. 5/ Observed flow minus diversion through Jones Pass Tunnel.

6/ Observed flow minus diversions from North Platte, Colorado and Laramie rivers plus measured diversions for irrigation and municipal use above station. 7/ Observed flow adjusted for change in storage in Clear Creek, Twin Lakes and Sugar Loaf reservoirs minus trans-mountain diversions through Busk-Ivanhoe and Twin Lakes Tunnels and Ewing, Fremont, Wurtz and Columbine Ditches. 8/ Observed flow adjusted for change in storage in Santa Maria, Rio Grande and Continental reservoirs. 9/ Observed flow adjusted for changes in storage in reservoirs listed in (8) plus Terrace, Sanchez, Platoro, and El Vado reservoirs. 10/ Observed flow adjusted for changes in storage in Granby Reservoir plus diversions through Adams Tunnel and Grand River Ditch.

11/ Observed flow adjusted for changes in storage in Flaming Gorge, Navajo, and Lake Powell. 12/ Observed flow plus diversion through Duchesne Tunnel. 13/ Observed flow adjusted for changes in storage in Flaming Gorge Reservoir. 14/ Observed flow adjusted for change in storage in Scofield Reservoir. 15/ Observed flow adjusted for change in storage in Navajo Reservoir.

16/ Observed flow adjusted for change in storage in Bear Lake Reservoir. 17/ Observed flow plus Utah Power and Light Tailrace and Logan, Hyde Park and Smithfield canals. 18/ Record computed by Bureau of Reclamation. 19/ Observed flow adjusted for change in storage in Deer Creek Reservoir, minus diversions through Duchesne Tunnel and Weber-Provo Canal, plus diversion through Salt Lake Aqueduct. 20/ Observed flow adjusted for change in storage in Otter Creek Reservoir.

21/ Observed flow adjusted for change in storage in Boca Reservoir but not Lake Tahoe. Forecast by Truckee Basin Water Committee. 22/ Observed flow adjusted for change in storage in Lake Chelan. 23/ Observed flow adjusted for change in storage in Flathead and Hungry Horse Reservoir. 24/ Observed flow adjusted for change in storage in any or all of the following reservoirs above the station: Kootenay Lake, Hungry Horse, Pend Oreille, Coeur d'Alene, F. D. Roosevelt, Lake Chelan, and Brownlee; and pumping to Banks Lake. 25/ Observed flow adjusted for change in storage in Coeur d'Alene Lake plus diversions to Spokane Valley Farms and Rathdrum Prairie Canals.

26/ Observed flow adjusted for change in storage in Mackay Reservoir plus diversion in Sharp Ditch. 27/ Combined flow of Big Wood near Belleview and Camas Creek near Blaine. 28/ Observed flow adjusted for changes in storage in Lucky Peak, Anderson Ranch and Arrowrock Reservoir. 29/ Observed flow adjusted for changes in storage in Cascade and Deadwood Reservoir. 30/ Observed flow adjusted for changes in storage in Palisades and Jackson reservoirs.

31/ Observed flow adjusted for changes in storage in Crane Prairie, Wickiup, and Crescent Lake reservoirs. 32/ Adjusted to natural flow. 33/ Observed flow adjusted for changes in storage in Lookout Point, Detroit, Cottage Grove, Dorena, and Hills Creek reservoirs. 34/ Observed flow adjusted for changes in storage in Keechelus, Kachess, Cle Elm, Bumping and Tieton reservoirs, plus diversions by Rosa, New Reservation, Old Reservation, and Sunnyside Canals. 35/ Flow records provided by COPCO and USBR.

36/ All forecasts are for unimpaired streamflow except Kaweah River. 37/ Not corrected for upstream impairments. All other forecasts are for observed flow.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
507 MAIN POST OFFICE BLDG.
PORTLAND 9, OREGON

OFFICIAL BUSINESS

POSTAGE AND FEES PAID
U. S. DEPARTMENT OF AGRICULTURE

FIRST CLASS MAIL

FEDERAL - STATE - PRIVATE

COOPERATIVE SNOW SURVEYS

Furnishes the basic data necessary for forecasting water supply for irrigation, domestic and municipal water supply, hydro-electric power generation , navigation , mining and industry

"The Conservation of Water begins with the Snow Survey"